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Imidazole I-quartet water and proton dipolar channels

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The complementarity of shape, dimensions and electrostatic profiles between interactional surfaces of biomolecules are considered to be major determinants of their functions. Interfacial or encapsulated water molecules, necessarily present in the contact space, are of crucial relevance for many biological scenarios like: biomolecular recognition and self-assembly, protein structure and activity, DNA conformation and recognition, proton(ion) and water-channel selectivity, etc. Regarding the basic principles of ion-transport along protein channels, they are related to large water-filled cavities in which the dipolar structure of the proteins help to overcome the high energy barrier of the translocation of the ions toward the selectivity filter. Synthetic robust counterparts have been developed with the hope of reproducing the complicate biological machinery. Electrostatic asymmetry, push and pull rigid rods or polarizable materials have been used to generate dipolar ion-pumping as observed with natural protein systems. Intuitively, interactions between chiral asymmetric surfaces and water might imply the generation of oriented dipolar surface-bonded water clusters. Within this context, it has been shown that chiral interactional surfaces are determinant for asymmetric tissue morphogenesis. Chiral imidazole-quartet nanotubes in which confined water molecules present a unique dipolar orientation can preserve the electrochemical potential along the channel. Further progress and mechanistic simplicity for ionic can be imagined by using dipolar water wires to control dipolar ion-pumping along chiral channels. Herein, nanosized pores with internal chiral surfaces have been used to generate electrostatic dipolar profiles of oriented water wires preserving electrochemical potential conservation along the channel in which protons and ions are envisioned to diffuse along the *dipolar hydrophilic pathways*. These systems has provided excellent reasons to consider that chirality and water induced polarization generating dipolar ion-pumping in ion-channels may in principle to be strongly associated.

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